NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF INDUSTRIAL AND SYSTEMS ENGINEERING
INDUSTRIAL ENGINEERING PROGRAM

SYLLABUS - TP203 INDUSTRIAL MACHINERY AND INSTRUMENTS

I. GENERAL INFORMATION

CODE	:	TP203
SEMESTER	:	5
CREDITS	:	2
HOURS PER WEEK	:	4 (Theory – Lab)
PREREQUISITES	:	CB312 Physics II
CONDITION	:	Compulsory
INSTRUCTOR	:	Guillermo Cruz, Antonio Zuniga

II. COURSE DESCRIPTION

This course provides students with the fundamental principles of the industrial technology, design techniques, methods, calculations, machine element selection (production, maintenance and quality control), use of tables, handbooks and software that allow industrial engineers to make incursions into technological transference, research and development projects of their specialty, and for that purpose the following subjects were considered: Crankshaft, rotors and linkage and screwed joints. Calculation of shaft, bearing and springs. Calculation of transmission with belts and types of belt, chain drive.

III. COURSE OUTCOMES

1. Properly use specialized software when calculating topics of machine elements.
2. Learn the operation principle of the crankshaft, and adequately select rotors, rings and linkages using industrial information.
3. Select adequate material according to its mechanical properties and determine the dimensions of screws, helical disk springs and transmission shaft.
4. Select and determine the main dimensions of bearing and type of lubrication according to its use, considering the most adequate linkages.
5. Determine characteristics and components of flat, Poly-V, V and timing belts and chains.

IV. LEARNING UNITS

1. CRANKSHAFT, ROTOR AND LINKAGES / 8 HOURS
Definition of crank, connecting rod and crankshaft / Principle of operation / Rotors: types, selection of rotors / Linkages: definition, types, election of the linkage size.

2. SCREWED JOINTS / 8 HOURS
Definition, mechanical characteristics / Main formulae used in screwed joints / Safety factor / Steels used / Power screw: Moment of rotation required for lifting and lowering a load / Main formulae used in calculations.

3. HELICAL AND DISK SPRINGS / 8 HOURS

Round-section helical spring: definition / Dimensions / Main dimensions / Characteristic curves / Formulae used in compression / Material used in springs / Disk spring: definition / Main dimension / Formulae and abacuses used in their calculation.

4. SHAFTS / 5 HOURS

General aspects / Main formulae / Determination of the shaft diameter applying distortion energy (DET), and the theory of shear (MSST) / Steel used in shafts.

5. BEARINGS / 8 HOURS

Definition, main parts / Selection of the bearing size / Dynamic load-bearing capacity / Factors to be considered / Diagrams of kinematic viscosity / Diagrams for determining bearing lubrication / Selection of settings and tolerance / Tolerances of axes and solid settings.

6. BELTS / 16 HOURS

Flat belts: Main dimensions / Analysis of forces / Selection of the power distribution, RPM, gear ratio, Poly-V belts: Characteristics / Election of profile / Selection from power, RPM, gear ratio / V-belts: Main dimensions, types of profiles / Selection from power, RPM, gear ratio / Timing belt: Selection method from a power, RPM, gear ratio.

7. CHAIN DRIVE / 8 HOURS

Definition, calculation of a chain drive, types of chains / Selection method of links and pinions / Importance of service factor / Number of links / Type of lubrication to be used.

V. LABORATORIES AND PRACTICAL EXPERIENCES

Lab 1: Rotor and linkages.
Lab 2: Screwed joints.
Lab 3: Helical springs in compression.
Lab 4: Disk springs.
Lab 5: Shafts.
Lab 6: Bearings.
Lab 7: Belt drive
Lab 8: Chain drive.

VI. METHODOLOGY

This course is carried out in theory and lab sessions. In theory sessions, the instructor introduces fundamental concepts of every single learning unit and practical applications using handbooks and graphics from the industrial sector. In lab sessions, Inventor Professional 2010, Tribology-abc, Arprix, Reich, SKF bearings, Hutchinson belts, SKF Power Transmission, Chain Selection Tsubaki software programs are used. In all sessions, students participation is encouraged, mainly in technological innovations in the course.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

PF = (EP + EF + (L1 + L2 + L3)/3)/3

EP: Mid-Term Exam EF: Final Exam
L#: Labs

VIII. BIBLIOGRAPHY

1. **JOSEPH E. SINGLEY – CHARLES R. MISCHKE**
   Mechanical Engineering Design (Spanish)
   Mc Graw Hill Editorial (2003)
2. **BERNARD J. HAMROCK – BO JACOBSON – STEVEN R. SCHMID**
   Machine Elements (Spanish)
   Mc Graw Hill Editorial (2000)
3. **ROBERT L. MOTT**
   Design of Machine Elements (Spanish)
   Prentice Hall Editorial (2006)